THE annual meeting of the Association of Directors and Secretaries for Education was held on January 1 in the council chamber of the London County Council, when an address on "The Finances of Education" was delivered by Mr. W. Avery Adams, chairman of the association and secretary to the Bristol Education Committee. In opening his address, Mr. Adams said that the scheme for raising the Bristol University College to the rank of a university, owing to the generosity of Mr. H. O. Wills, promises shortly to be carried into effect, thus securing for the west of England the same opportunities for intellectual and professional training as are available in other parts of the country. Alluding to the Scottish Education Act, he directed attention to the powers which are to be granted to school boards in Scotland to compel attendance at continuation classes up to the age of seventeen. If such a remedy for the educational leakage which now went on is practicable in Scotland, said Mr. Adams, surely it is not unreasonable to suggest that it is practicable in England. The principal theme of the address was the finances of education, and Mr. Adams insisted that one of the chief hindrances to progress is the financial strain now put upon the local education authorities (1) by the imposition on the part of the State of new and onerous duties; (2) by the continual growth of what may be termed the ordinary items of expenditure; and (3) by the failure of Whitehall to contribute a fair share of the total burden of the increasing cost. The development of our educational system, which has advanced enormously during the last six years, has also entailed a large annual increment to the rates; and, apart from what has already been accomplished, there are still many urgent educational reforms which would doubtless be undertaken by local authorities if it were not for the reluctance of Whitehall to bear a fair share of the cost involved in carrying out the improvements. Among these reforms may be placed:—(1) the reduction in the size of the classes; and (2) the replacement of supplementary teachers by certificated teachers. The Government grant in support of national elementary education is totally inadequate. In conclusion, Mr. Adams emphasised the fact that the exiguous grant given by the State to the local universities, which have now become an indispensable part of our educational system, is not creditable to a wealthy and progressive nation like ours. The outcry heard against the growing burden of the cost of education is not the expression of a spirit of grant-greed, but represents a fear that through inadequate Government support the schools may send forth scholars who will not be equipped properly for the warfare of life or for taking their part in the struggle which has to be made unceasingly for the maintenance of the commercial and industrial position of our nation.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 12, 1908.—"The Occlusion of the Residual Gas and the Fluorescence of the Glass Walls of Crookes Tubes." By Alan A. Campbell **Swinton**. Communicated by Sir William Crookes, F.R.S.

In a previous paper[1] the writer has described experiments indicating that the occlusion of the gas is due to its being driven into the glass, in which it forms bubbles on subsequent heating.

The present paper deals with Mr. Robert Pohl's suggestion that the bubbles are not due to the gas at all, but to chemical action on the glass, when heated, of aluminium disintegrated from the electrodes.

The author finds that after prolonged sparking portions of the internal surface of the glass of tubes with external electrodes consisting of caps of tinfoil show numerous but very small bubbles when heated. This, as it would seem, entirely disposes of Mr. Pohl's contention.

The electric discharges passed through the tubes were so weak that the heating of the glass was very slight. The temperature cannot thus have been sufficiently raised either to allow of the gas passing into the glass by ordinary diffusion, as suggested by Sir J. J. Thomson, or of the gas being evolved inside the glass by chemical decomposition due to heat, as put forward by Mr. Soddy and Mr. Mackenzie.

Grinding away the glass to the extent just necessary to prevent the formation of bubbles on subsequent heating also showed that the depth to which the gas is driven into the glass varied from 0·0025 mm. for tubes with external electrodes to as much as 0·015 mm. with internal electrodes, the distances being in all cases considerably less—about one-tenth—than the distances between the surface of the glass and the centres of the bubbles produced by subsequent heating.

By means of a fluorescent screen placed behind a patchwork screen of different thicknesses of aluminium foil, it was ascertained that the maximum thickness of aluminium through which kathode rays will pass is about 0·014 mm., which agrees very fairly with the above-mentioned figure of 0·015 mm.

Thus neither the explanation of Sir J. J. Thomson nor that of Mr. Soddy and Mr. Mackenzie seem necessary, for the gas in the first instance travels into the glass only about the same distance that kathode rays penetrate into aluminium, and it is therefore reasonable to suppose that the gas is driven in mechanically according to the writer's original contention. Diffusion, however, probably takes place when the glass is softened in the flame, when the gas penetrates further and forms bubbles on cooling, in much the same way that air bubbles are formed in ice.

Experiments were also made on the fatigue of the glass in respect to fluorescence. Except in cases where this fatigue was due to deposits of electrode matter or of carbon, it was found necessary, in order to do away with it, to grind away a thickness of glass approximately the same as had to be removed to prevent the formation of bubbles on subsequent heating. It would therefore appear that fatigue is intimately connected with, and is perhaps the direct result of, the penetration and presence of the occluded gas. That part of this fatigue is very permanent is shown by a tube in the author's possession, which still shows fatigue due to bombardment it received in 1898. Though part of the fatigue is permanent, most of it is but temporary. This may be due to the gradual escape of such portion of the gas as has been driven into the glass only such a very short distance that the latter is unable permanently to retain it.

PARIS.

Academy of Sciences, December 28, 1908.—M. Bouchard in the chair.—The lava of the last eruptions of Vulcano, Eolian Isles: A. **Lacroix.** In the cases of Mt. Pelée, Vesuvius, and Etna it has been proved that in a given eruption any changes in the chemical composition of the lava are very slight, and are not systematic. Observations published by various authors on the products of the last eruption of Vulcano appear to lead to different conclusions. Various specimens of the lava from this eruption have been analysed, and the existence of such marked differences is not confirmed.—Some properties of the tubercle bacillus cultivated on bile: H. **Calmette** and C. **Guérin.** The authors are convinced that experiments in tuberculosis in which cultures in glycerol, gelatin, potato, or broth are used give different results from those of natural infection. They have found that the bacillus grows perfectly on pure bile with 5 per cent. of glycerin and sterilised, and after several successive cultures on this medium it acquires very distinct physiological characters. Full details are given of the mode of working and of the appearance and properties of the bacillus thus obtained. It is easily absorbed through the wall of the digestive tube, and when it has penetrated in sufficient quantity in this way it can create lesions with rapid calcification such as could never be obtained experimentally with cultures in ordinary glycerin media.—M. Villard was elected a member in the section of physics in the place of the late E. Mascart.—Concerning the distribution of the aphelia of the minor planets: Emile **Belot.** A diagram is given of the distribution.—The use of coloured screens and orthochromatic plates for the photographic observation of the fixed stars: Œsten **Bergstrand.** The combination of a yellow screen and an orthochromatic plate produces much greater clearness in the images, and also eliminates the

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[1] "The Occlusion of the Residual Gas by the Glass Walls of Vacuum Tubes," Roy. Soc. Proc., A, vol. lxxix., pp. 134-7.

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harmful influence of atmospheric refraction. It is to be recommended in all precise measurements of position, and especially in work on stellar parallax.—The principles of flight with wings: L. **Thouveny.**—A special model of a balloon: M. **Radiot.**—The problem of efforts in the theory of elasticity: A. **Korn.**—The magnetic rotatory power of the vapour of calcium fluoride and of nitrogen peroxide in the neighbourhood of their absorption bands: A. **Dufour.** The vapour of calcium fluoride in the magnetic field possesses a positive magnetic rotatory power outside and near the doublets of all the components of the band D″ and negative in their interior; the rotation may attain a value of 40° to 50° in the centre of the doublets. Similar observations on nitrogen peroxide are described.—The law of the maximum of kathode phosphorescence in binary systems: G. **Urbain.** It is now well established that, in opposition to the views of Sir W. Crookes, pure substances do not give rise to phosphorescence. A brilliant phosphorescence is always the result of a mixture of two substances, and there is a certain percentage of one of them which gives a maximum result.—The electrical resistance of the alkali metals, of gallium, and of tellurium: A. **Guntz** and W. **Broniewski.** These metals were introduced into a U-shaped capillary tube, with suitable precautions as to purity and freedom from oxidation. The resistances of cæsium, rubidium, potassium, sodium, and lithium were measured at −187°, −78°·3, 0°, and a fourth higher temperature, and the results compared with those calculated from the formula

$$r_t = (2F + T) \times \text{constant},$$

in which r_t is the resistance at the temperature t, F the absolute temperature of fusion, and T the absolute temperature of the body. Measurements are also given for gallium in both the solid and liquid state and for tellurium.—The reduction of uranyl chloride: Œchsner **de Coninck.** An attempt was made to determine the atomic weight of chlorine by reducing $U_2O\,Cl_2$ in hydrogen at a red heat. but the results were found to be of no value.—The preparation of ether salts of the cyclic series: A. **Béhal.** A mixture of acetic acid and benzyl chloride, heated to the boiling point, slowly gives off hydrochloric acid, benzyl acetate being formed. The action is accelerated by the presence of certain catalytic agents, bismuth chloride being especially active in this respect.—The preparation and properties of β-gluco-heptite: L. H. **Philippe.** By reducing the gluco-heptonic lactone obtained from ordinary glucose with sodium amalgam, E. Fischer obtained β-glucoheptose. The author, by pushing the reduction a stage further, has prepared a new heptavalent alcohol, β-glucoheptite, the physical and chemical properties of which are given.—The facies of natural crystals: Paul **Gaubert.**—The development of the perennial plant compared with that of the annual plant: G. **André.**—The presence of urea in some of the higher fungi: A. **Goris** and M. **Mascre.** Certain species of fungi have been found to contain from 2·7 to 4·3 per cent. of urea. It still remains to be proved whether the urea was present as such in the fungus, or was formed during the process of drying.—A new artificial peroxydase: E. **de Stœcklin.** Tannate of iron acts as a peroxydase, the monophenols being attacked with especial ease.—The green pigment of the bile: M. **Piettre.**—The physiological function of the arborescent glands connected with the female generating apparatus of *Periplaneta orientalis*: L. **Bordas.**—The stratigraphical definition of the Sicilian stage: **Maurice Gignoux.**

DIARY OF SOCIETIES.

THURSDAY, January 7.

Röntgen Society, at 8.15.—A Description of Three Sub-standards of Radio-activity recently prepared for the Röntgen Society: C. E. S. Phillips.—A New Localising Apparatus designed by Staff-Surgeon Dr. Gillett: H. C. Head.

FRIDAY, January 8.

Royal Astronomical Society, at 5.—A New Dividing Engine: G. T. McCaw.—Fluctuations in the Moon's Mean Motion: Prof. Simon Newcomb.—Observations of Comet *c* 1908, Morehouse: R. C. Johnson.—Development of the Disturbing Function in Planetary Theory in Terms of the Mean Anomalies and Constant Elliptic Elements: P. H. Cowell.—Note on Major MacMahon's Paper on the Determination of the Apparent Diameter of a Fixed Star: A. S. Eddington.—*Probable Papers:* On a Chinese Planisphere: E. B. Knobel.—Observations of Occultations of Stars by the Moon in the Year 1908: Royal Observatory, Greenwich.—Observations of Saturn's Ninth Satellite, Phœbe, from Photographs taken with the 30-inch Reflector in 1908: Royal Observatory, Greenwich.

MONDAY, January 11.

Royal Geographical Society, at 8.30.

TUESDAY, January 12.

Zoological Society, at 8.30.—Zoological Results of the Third Tanganyika Expedition, conducted by Dr. W. A. Cunnington, 1904–5.—Report on the Copepoda: Prof. G. O. Sars.—Studies on the Flagellate Blood Parasites of Freshwater Fishes: Prof. E. A. Minchin.—A Further Note on the Gonadial Grooves of a Medusa, *Aurelia aurita*: T. Goodey.—The Tuberculin Test in Monkeys, with Notes on the Temperature of Mammals: Dr. A. E. Brown.—A few Notes on *Balaena glacialis* and its Capture in Recent Years in the North Atlantic by Norwegian Whalers: Prof. R. Collett.

WEDNESDAY January 13.

Geological Society, at 8.—On Labradorite-Norite with Porphyritic Labradorite Crystals; a Contribution to the Study of the "Gabbroidal Eutecticum": Prof. Johan H. L. Vogt.—On the Genus Loxonema, with Descriptions of New Proterozoic Species: Mrs. Jane Longstaff.

Society of Public Analysts, at 8.—(1) The Analysis of Complex Candle Mixtures; (2) The Detection and Estimation of Mercury in Nitro-Explosives: Otto Hehner.

THURSDAY, January 14.

Royal Society, at 4.30.

Institution of Electrical Engineers, at 8.—The G. B. System from a Tramway Manager's Point of View: Stanley Clegg.

FRIDAY, January 15.

Institution of Mechanical Engineers, at 8.—The Filtration and Purification of Water for Public Supply: John Don.

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